PORTLAND HARBOR RI/FS

DRAFT FINAL REMEDIAL INVESTIGATION REPORT

APPENDIX F

BASELINE HUMAN HEALTH RISK ASSESSMENT

ATTACHMENT F6: SUPPORTING DOCUMENTATION FOR UNCERTAINTY ANALYSIS

This draft document has been provided to EPA at EPA's request to facilitate EPA's comment process on the document in order for LWG to finalize the BHHRA. The comments or changes (including redlines) on this document may not reflect LWG positions or the final resolution of the EPA comments.

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1.0 Overview

An uncertainty assessment is presented in Section 6 of the Baseline Human Health Risk Assessment (BHHRA) provided as Appendix F of the Portland Harbor Remedial Investigation Report. The uncertainty assessment presents some of the uncertainties with a quantitative evaluation, and some are discussed in a qualitative manner. This attachment to the BHHRA provides a description of the quantitative analyses performed in the uncertainty assessment.

2.0 Quantification of Uncertainties and Variability

A description of the quantification of uncertainties for the BHHRA is provided below.

2.1 USE OF EITHER WHOLE BODY OR FILLET SAMPLES TO REPRESENT ALL FISH CONSUMPTION

The uncertainty associated with using only whole body or only fillet tissue to evaluate risk from all types of fish tissue diets was evaluated by analyzing fish tissue data used in the BHHRA for selected chemicals. The uncertainty for preference of tissue type consumed is associated with both lack of knowledge and variability, given that the preference for tissue type may both be uncertain and vary from member to member of the receptor population. Differences between fillet and whole body samples depend upon the manner in which the fillet is separated from the rest of the fish.

Fillets with skin and the remainder of body were analyzed separately in Round 3B for smallmouth bass and common carp. Whole body concentrations were calculated from these results on a weighted average basis, which provided the opportunity to compare concentrations of chemicals in the fillet tissue with concentrations in the whole body tissue for the same fish tissue sample. The chemicals evaluated for this analysis were PCBs, since they contribute to the majority of risks from tissue consumption in the BHHRA and preferentially accumulate in fatty tissue; and mercury, because it preferentially accumulates in muscle tissue and would provide a range of the differences between concentrations in the two tissue types.

In the Round 3B smallmouth bass samples, the concentration of total PCBs in fillet tissue ranged from 11 to 22 percent of the whole body concentration (approximately 4 to 10 times higher in whole body tissue). In the Round 3B common carp samples, the concentration of total PCBs in fillet tissue ranged from 50 to 80 percent of the whole body concentration (approximately 1 to 2 times higher in whole body tissue).

In the Round 3B smallmouth bass samples, the concentration of mercury in fillet tissue ranged from 100 to 220 percent of the whole body concentration (approximately 1 to 2 times lower in whole body tissue). In common carp samples, the concentration of mercury in fillet tissue ranged from 110 to 140 percent of the whole body concentration (approximately 1 to 1.5 times lower in whole body tissue).

Table F6-1 compares PCB and mercury concentrations in fillet and whole body tissue for smallmouth bass and common carp.

2.2 USING N-QUALIFIED DATA

N-qualified data were used in the BHHRA for calculating tissue exposure point concentrations (EPCs). The N-qualifier indicates that the identity of the analyte is not definitive. The use of the N qualifier is generally a result of the presence in the sample of an analytical interference such as hydrocarbons or, in the case of pesticides, PCBs. Pesticide data and SVOCs analyzed by EPA Method 8081A were most commonly N-qualified. N-qualified data used in the calculation of EPCs for hexachlorobenzene and several pesticides resulted in cancer risk estimates exceeding 1×10^{-6} or HIs exceeding 1. Given the uncertainty in the identification of the analyte for N-qualified data, the use of N-qualified data introduces uncertainty in these risk estimates. This uncertainty is associated with the lack of knowledge regarding the identification of an analyte for N-qualified data.

For the purposes of this uncertainty assessment, EPCs and risk estimates were recalculated for adult fisher consumption of whole body fish tissue and shellfish tissue with the BHHRA dataset excluding N-qualified data. Results are shown in Table F6-2. For adult fisher consumption of black crappie, six of seven N-qualified chemicals are no longer identified as contaminants of potential concern (COPCs) when the N-qualified data are removed (i.e., these chemicals were no longer detected at least once in the respective fish tissue data set). Exposure to the revised EPC of the remaining N-qualified COPC, Total DDT, results in a change in risk estimates of less than one order of magnitude. For adult fisher consumption of brown bullhead, four of eight N-qualified chemicals are no longer identified as COPCs when N-qualified data are removed, and the revised EPCs for the remaining COPCs result in decreases of up to a factor of two in risk estimates, though do not change the identification of contaminants potentially posing unacceptable risks. For adult fisher consumption of smallmouth bass, common carp, and shellfish, removal of N-qualified data results in minor changes in risk estimates. However, beta-hexachlorocyclohexane is no longer identified as a COPC for clam consumption by an adult fisher.

Chemicals identified as contaminants potentially posing unacceptable risks (i.e., resulting in cancer risks greater than 1×10^{-6} or HQs greater than 1) based solely on N-qualified data were evaluated further. These chemicals are:

- Heptachlor epoxide for clams. The identification of heptachlor epoxide as a contaminant potentially posing unacceptable risks was based on one N-qualified result in an undepurated sample collected from river mile (RM) 6 during Round 1. Heptachlor epoxide was also detected in clam samples collected during Round 3, including samples from RM 6. The Round 3 data were not N-qualified and did not result in cancer risks greater than 1×10^{-6}.
- Alpha-hexachlorocyclohexane (alpha-HCH) for black crappie. The identification of alpha-HCH as a contaminant potentially posing unacceptable risks was based on a single N-qualified result in a whole body sample collected from RM 6 to 9. Alpha-HCH was also detected in smallmouth bass and common carp in the Round 3 samples (which did not include black

crappie). The Round 3 data were not N-qualified and did not result in cancer risks greater than 1×10^{-6} for those species.

- Beta-hexachlorocyclohexane (beta-HCH) for smallmouth bass. The identification of beta-HCH as a contaminant potentially posing unacceptable risks was based on a single N-qualified result in a fillet sample collected from RM 3 in Round 1. Beta-HCH was not detected in the whole body sample collected from RM 3 in Round 1 or in the fillet samples collected from RM 3 in Round 3. Beta-HCH was detected in other smallmouth bass samples collected during Round 3. The Round 3 data were not N-qualified and did not result in cancer risks greater than 1×10^{-6}.
- Gamma-hexachlorocyclohexane (gamma-HCH) for brown bullhead. The identification of gamma-HCH as a contaminant potentially posing unacceptable risks was based on two N-qualified results in whole body samples collected from RM 3 to 6 and one N-qualified result in a whole body sample collected from RM 6 to 9. Gamma-HCH was also detected in smallmouth bass and common carp in the Round 3 samples (which did not include brown bullhead). The Round 3 data were not N-qualified and did not result in cancer risks greater than 1×10^{-6} for those species.
- Heptachlor for black crappie. The identification of heptachlor as a contaminant potentially posing unacceptable risks was based on a single N-qualified result in a whole body sample collected from RM 3 to 6.

The chemicals identified as contaminants potentially posing unacceptable risks based only on N-qualified data were for fish and shellfish consumption scenarios. To assess whether the chemical might be present in the biota sample at concentrations potentially posing unacceptable risks even though the analytical result was not definitive, sediment data for those chemicals were also evaluated. Table F6-3 summarizes the results of the evaluation. For clams and smallmouth bass, which were collected over a smaller spatial scale than the other species, the evaluation suggests that the identification of the contaminants as potentially posing unacceptable risks is not supported by the sediment data. Heptachlor epoxide was detected in six in-water sediment samples collected from RM 6 east, and five of the six sediment samples were N-qualified as well. Beta-HCH was detected in all of the in-water sediment samples included in the BHHRA database. The maximum detected in-water sediment concentration of beta-HCH in RM 3 to 4 (7.99 micrograms per kilogram) is less than the maximum detected concentration in the Study Area (20.3 micrograms per kilogram), indicating that beta-HCH concentrations in RM 3 to 4 are not higher than at other locations within the Study Area. This analysis indicates there is uncertainty in identifying contaminants as potentially posing unacceptable risks based on N-qualified data only.

2.3 EXPOSURE PARAMETERS FOR TISSUE CONSUMPTION SCENARIOS

The uncertainty for tissue consumption rates is associated with both lack of knowledge and variability, given that the tissue consumption rate may both be uncertain and vary from member to member of the receptor population. The range of the magnitude of uncertainty associated with tissue consumption rates used in the BHHRA was determined by calculating the ratio of upper end consumption rates from the studies cited in Section 6 of the BHHRA with the mean consumption rates from the same studies, as follows:

Adult Fisher consumption of fish [*source*: CSFII (USDA 1998)]:

142 grams per day (g/day) divided by 7.5 g/day = 20 (after rounding)

Where:

142 g/day = 99th percentile rate from study, freshwater and estuarine fish and shellfish. Highest rate used in BHHRA.
7.5 g/day = mean rate from study.

Tribal Fisher consumption of fish [*source*: CRITFC 1994]:

175 g/day divided by 63 g/day = 3 (after rounding)

Where:

175 g/day = 95th percentile rate from study. Highest rate used in BHHRA.
63 g/day = mean rate from study.

Adult Fisher consumption of shellfish [*source*: CSFII (USDA 1998)]:

18 g/day divided by 3.3 g/day = 5 (after rounding)

Where:

18 g/day = 95th percentile rate for shellfish in freshwater and estuarine habitats combined, from study. Highest rate used in BHHRA.
3.3 g/day = mean rate from study.

The above calculations only show how the range of uncertainty was quantified for purposes of the BHHRA. A more detailed discussion of uncertainties in the tissue consumption scenarios is provided in Section 6 of the BHHRA.

2.4 ASSUMPTIONS ABOUT A MULTI-SPECIES DIET

The adult and child fisher multi-species diet assumes equal proportions of all four resident fish species. The adult and child tribal fisher multi-species diet consists of equal proportions of the four resident fish species, as well as dietary percentages of salmon, lamprey, and sturgeon that come from the CRITFC Fish Consumption Survey (CRITFC 1994). The uncertainty for assumptions for a multi-species diet are associated with both lack of knowledge and variability, given that the preference for fish species consumed may both be uncertain and vary from member to member of the receptor population. Uncertainties associated with these assumptions were evaluated by comparing risks from single-species diets with the risks from the multi-species diets, to encompass the full range of possible dietary proportions from each species of fish.

Table F6-4 shows that the cancer risk estimates from consumption of whole body fish tissue of a single species by an adult fisher ranged from 0.1 to 7 times the same cancer risk estimates from an equally proportioned multi-species diet. The cancer risk estimates from consumption of fillet fish tissue of a single species by an adult fisher ranged from less than 0.1 to 9 times the same risks from an equally proportioned multi-species diet. This indicates that assuming an individual consumes only a single species diet of fillet tissue could result in risks higher by a factor of less than 0.1 to 9, depending on the species, than an individual who consumes a multi-species diet..

2.5 USING 5-10 SAMPLES TO CALCULATE THE 95% UCL ON THE MEAN

Using fewer than ten sample results to calculate a 95% UCL on the mean increases the uncertainty associated with the 95% UCL for certain calculation methods. EPA's ProUCL software will not compute UCLs for datasets with less than 5 samples, and 8 to 10 samples are recommended in order to achieve reliable results. The Study Area-wide fish tissue EPCs that were calculated as 95% UCL on the mean concentrations using fewer than 10 samples included the Study Area-wide EPCs for whole body tissue of brown bullhead and fillet tissue of common carp. The maximum EPCs for the individual exposure points for whole body brown bullhead and fillet common carp were up to two times higher than the Study Area-wide EPCs.

The comparison of maximum detected concentrations and the Study Area-wide EPCs based on fewer than 10 samples is presented in Table F6-5 for PCBs and dioxins/furans. There was a 1 to 2-fold difference in the EPCs calculated with fewer than 10 samples versus the maximum detected concentrations.

2.6 USING THE MAXIMUM CONCENTRATION TO REPRESENT EXPOSURE

An evaluation was performed to quantify the range of uncertainty associated with using the maximum concentration to represent exposure, which was done in exposure areas with less than five detected concentrations. This uncertainty is associated with lack of knowledge given that increased sample size would reduce the lack of knowledge regarding the population distributions of sample concentrations. The use of maximum detected concentrations as EPCs for exposure areas with less than 5 detected concentrations was agreed upon with EPA as described in Attachment F1. The evaluation of this uncertainty included outlier tests and comparisons of maximum concentrations to mean concentrations for the same exposure area that are provided in Tables F6-6 to F6-9.

For in-water sediment, there were only two cases for which the maximum detected concentration was used as the EPC and the risk estimate was greater than 1×10^{-6}: exposure by a tribal fisher at the exposure points RM 1.5E (benzo[a]pyrene) and RM 11E (PCB congeners).

Except for the EPC calculated for location 7W for clams, for the calculation of all shellfish station tissue EPCs, the maximum concentrations were used because fewer than 5 composite tissue samples were collected per station. As shown in Tables F6-6 through F6-9, the ratios of the maximum concentrations to the mean concentrations are generally within an order of magnitude. The maximum values listed in the tables are limited to those chemicals and exposure media for which the maximum value was used as the RME and more than one sample was collected for the exposure area. For surface water (Table F6-6), all of the ratios between the maximum and minimum concentration values shown are less than 2, with the exception of benzo(a)pyrene at RM 6, which has a maximum to minimum concentration ratio of 2.7. Ratios for in-water sediments (Table F6-7) are typically less than 3, and all ratios are less than 4. When comparisons are made within an exposure area for fish tissue risk results, the majority of the ratios are equal to or less than 2, and none exceed 4 (Table F6-8). Maximum cancer risk values for fish tissue correspond to the 142 g/day consumption rate for adult non-tribal fishers, and maximum non-cancer HIs correspond to the 60 g/day consumption rate for child non-tribal fishers.

There was one smallmouth bass sample collected during the Round 3 sampling effort at RM 10E (LW3-SB010E-C00B) with anomalously high detected concentrations of lead and antimony in the tissue analyzed as whole body without fillet. The tissue sample was reanalyzed, as described in the Round 3B Fish and Invertebrate Tissue and Collocated Sediment Data Report, Addendum 1 (Integral 2008). Due to the consistently high detection of these compounds in this sample, the results of the lead and antimony analyses for this sample were averaged for use in the BHHRA. The lead concentration in body without fillet tissue for this sample is 1640 milligrams per kilogram (mg/kg), which is over 160 times higher than the next highest lead

concentration for smallmouth bass in the Study Area. The antimony concentration in body without fillet tissue for this sample is 8.41 mg/kg, which is also approximately 160 times higher than the next highest antimony concentration in smallmouth bass for the Study Area. As discussed in the Round 3B Fish and Invertebrate Tissue and Collocated Sediment Data Report, Addendum 1, these elevated concentrations are consistent with what would be expected from fish that swallowed fishing gear containing lead and antimony or other similar metal objects. These concentrations may not be representative of tissue concentrations resulting from exposure to CERCLA-related contamination within the Study Area. However, these concentrations were used with the corresponding fillet concentrations to calculate a whole body concentration for use in the BHHRA, which was also anomalously high. The concentrations of lead and antimony for this sample (LW3-SB010E-C00WB) were the maximum concentrations for the RM 10E smallmouth bass exposure area, and due to the low number of smallmouth bass samples within the exposure area, they were used as the EPCs. The maximum concentrations of this sample are an extremely conservative estimate of exposure from this river mile stretch, and do not represent average exposure from smallmouth bass tissue at this exposure area. The concentrations from this sample were also used in the calculation of Study Area-wide EPCs for smallmouth bass, creating a high bias in the dataset. Although lead would still be considered a contaminant potentially posing unacceptable risks for smallmouth bass if this sample were removed from the dataset, antimony would not be a contaminant potentially posing unacceptable risks.

2.7 POSSIBLE EFFECTS OF PREPARATION AND COOKING METHODS

As discussed in Section 6 of the BHHRA, cooking and preparation methods of fish tissue can modify the amount of contaminant ingested by fish consumers. The uncertainty for possible effects of preparation and cooking methods are associated with both lack of knowledge and variability, given that the preference for fish preparation methods may both be uncertain and vary from member to member of the receptor population. Furthermore, there is variability in the degree of cooking loss for each preparation method. The results of a study by Wilson et al. (1998) were used to bound the magnitude of uncertainty associated with the BHHRA, which did not account for possible effects of preparation and cooking. The Wilson study showed that PCB concentrations would be reduced by a factor up to 87 percent, depending on cooking methods. However, unless preparation and cooking methods are known for particular receptors, the overall uncertainty is unknown, and the overall effect will likely be more modest than 87 percent.

EPA guidance (2000) includes a summary of contaminant reductions due to skinning, trimming, and cooking. These reductions are summarized for PCBs in Table F6-10. The percent reductions range from 16 to 80 percent, depending on species and preparation/cooking method.

2.8 BIOAVAILABILITY OF CHEMICALS

Studies have shown that conditions in environmental media (e.g., pH, organic carbon content) can affect the bioavailability of a chemical (Ruby et al. 1999, Pu et al. 2003, Saghir et al. 2007). This uncertainty is associated with both lack of knowledge and variability. The uncertainty is associated with lack of knowledge because of the restrictions of scientific study to limit the number of environmental conditions, test organisms, and chemicals evaluated for bioavailability. This uncertainty is also associated with the temporal and spatial variability of conditions in environmental media (e.g., pH, organic carbon content) over the exposure duration and exposure area for each exposure scenario.

2.9 TOXICITY VALUES FOR POLYCHLORINATED BIPHENYLS AND APPLICABILITY TO ENVIRONMENTAL DATA

As discussed in Section 6, uncertainties exist in the toxicity values for PCBs and their applicability to environmental data. This uncertainty was bounded for the purposes of this uncertainty analysis by calculating the ratio of the oral slope factors for High Risk PCBs to Low Risk PCBs, as follows:

$$\frac{\text{2.0 Oral Slope Factor for High Risk PCBs}}{\text{0.07 Oral Slope Factor of Low Risk PCBs}} = 30 \text{ (after rounding)}$$

This uncertainty is associated with the lack of knowledge of toxicity of PCB mixtures present in the environmental media evaluated under each exposure scenario and exposure point.

The EPA document titled Cancer Dose-Response Assessment and Application to Environmental Mixtures (EPA/600/P–96/001F, September 1996) presents the rationale for the use of 3 different cancer slope factors for PCBs. Three slope factors are provided: 2 per milligrams per kilogram per day (mg/kg-day) for high risk and persistence PCBs, such as Aroclor 1260 and 1254; 0.4 per mg/kg-day for low risk and persistence PCBs, such as Aroclor 1242; and 0.07 per mg/kg-day for lowest risk and persistence PCBs, such as Aroclor 1016. The high risk and persistence value should be used for those exposure pathways associated with environmental processes that tend to increase risk, including: food chain exposure; sediment or soil ingestion; dust or aerosol inhalation; dermal exposure (if an absorption factor has been applied); the presence of dioxin-like, tumor-promoting, or persistent congeners in other media; and early-life exposure (all pathways and mixtures). The low risk and persistence value should be used for those exposure pathways that tend to decrease risk, including: ingestion of water-soluble congeners, inhalation of evaporated congeners, and dermal exposure if no absorption factor has been applied. The lowest risk and persistence value should be used where congener or isomer analyses verify that congeners with more than four chlorines comprise less than one-half percent of total PCBs, suggesting that potency is best represented by the least potent tested mixture. All of the pathways assessed in the BHHRA are included under the criteria for use of the

high risk and persistence cancer slope factor of 2 per mg/kg-day. Even for scenarios where adults only (not children) ingest water, surface water data would contain both water soluble congeners and those found in water-borne colloidal material and particulate matter.

2.10 RISKS FROM CUMULATIVE OR OVERLAPPING SCENARIOS

In calculating the cumulative risks from overlapping scenarios, the maximum cancer risk and noncancer hazard for each RME scenario was used, respectively. The uncertainty associated with this calculation was determined by comparing the difference between summing the maximum for each RME scenario and summing the respective minimum cancer risk and noncancer hazard estimates for each RME scenario. This uncertainty is associated with both lack of knowledge and variability. There is a lack of knowledge of the true extent to which exposure scenarios overlap and the true extent of overlapping exposure scenarios may vary from member to member of the population.

2.11 LIMITING ENDPOINT-SPECIFIC HIs FOR A CHEMICAL TO ONE ENDPOINT

In deriving endpoint-specific HIs, only one health endpoint is used for each chemical, even though most chemicals can have a myriad of health effects as exposures increase. While the individual HQ for additional effects will be lower than that based on the critical study, not considering these additional endpoints may underestimate the potential for adverse effects in the endpoint-specific HIs. Because cumulative HIs were calculated without regard for the toxicity endpoint prior to calculating the endpoint-specific HIs, the cumulative HIs in the BHHRA are not be affected by multiple endpoints for individual chemicals.

2.12 UNCERTAINTIES RESULTING FROM ELIMINATION OF EXPOSURE PATHWAYS IN THE BHHRA

Section 3.2.1 of the BHHRA initially describes different categories for exposure pathways (complete, incomplete, complete and significant, etc.). Complete and significant pathways are further discussed in the BHHRA, but uncertainty exists in the elimination of incomplete and insignificant pathways. However, the pathways chosen for further evaluation in the BHHRA are assumed to be protective of other pathways.

2.13 ELIMINATION OF DATA FROM OUTSIDE THE STUDY AREA IN SCREENING FOR COPCS IN IN-WATER SEDIMENT AND SURFACE WATER

During the screening for COPCs described in Section 3, data from outside the Study Area were not used for in-water sediments or for surface water. For in-water sediment, samples excluded from the COPC screening dataset were those samples collected in Multnomah Channel, samples collected from RM 1 to 1.9, and samples collected from RM 11.8 to 12.2. All analytes detected in samples outside of the Study Area were also detected inside the Study Area. For surface water, there was only one sample location outside of the Study Area that was excluded from the COPC screening dataset (Multnomah Channel). Analytes detected in Multnomah Channel were also detected in the Study Area. Elimination of these data introduce uncertainty in the COPC screening, however, this uncertainty is not expected to affect the overall conclusions of the BHHRA.

2.14 EXCLUSION OF NON-DETECTED CONCENTRATIONS THAT ARE HIGHER THAN THE HIGHEST DETECTED CONCENTRATION

EPA guidance notes that non-detect values for which the detection limit is greater than the maximum reported concentration for a specific chemical/media should be excluded when inclusion of the data results in a calculated EPC that exceeds the maximum reported concentration. For the BHHRA, all non-detect data greater than the maximum detection limit per exposure area were excluded, introducing uncertainty in the risk results. Tables F2-7 through F2-13 in Attachment F2 show non-detect data that are greater than the maximum detection limit per exposure area for different media, species, tissue type, and exposure area. These tables also indicate whether the non-detected results are at least two orders of magnitude greater than the maximum detected concentration. Many of these analytes are already classified as primary contributors to risk, and therefore this uncertainty is not expected to affect the overall conclusions of the BHHRA.

2.15 UNCERTAINTIES IN THE DERMAL TOXICITY ASSESSMENT

The approach used to evaluate dermal risk could underestimate risk by a factor of up to 2, since no adjustments to slope factors or RfDs are required if oral absorption efficiency is greater than 50 percent.

2.16 POLYCHLORINATED BIPHENYLS

Section 6.2.6 of the BHHRA describes an analysis of the correlation of the results of whole body tissue samples for PCBs as Aroclors and as individual congeners. A comparison of the results for PCBs as Aroclors and PCBs as individual congeners for tissue samples is provided in Table F6-11. This comparison is based on the whole

body tissue data from Round 1, which is the only sampling event where Aroclors and congeners were analyzed in the same tissue samples. As shown in Table F6-11, sometimes the congener results are higher and other times the Aroclor results are higher. Risks from total PCBs in tissue are calculated based on PCB congeners when congener data were available, which introduces uncertainty into the risk estimates.

Fillet tissue samples collected in Round 1 were analyzed for Aroclors only, and Round 3 samples (smallmouth bass and common carp) were analyzed for PCB congeners only. While risks were estimated for both the Aroclor and congener results, the cumulative risks were based on PCB congener data when congener data were available, which resulted in using the Round 3 data instead of the Round 1 data. To assess the uncertainty in using the Round 3 data versus the Round 1 data, the results for Aroclors and congeners in smallmouth bass and common carp fillet tissue were compared, as provided in Table F6-12. This comparison shows that for the same exposure area where both congener and Aroclor data are available, sometimes the congener results (i.e., Round 3 data) are higher and other times the Aroclor results (i.e., Round 1 data) are higher. However, these results are not for the same fish tissue samples so the difference in concentrations could be due to heterogeneity in the tissue samples as opposed to the sampling event or analytical method. On a Study Area-wide basis, the congener results are higher than the Aroclor results. The availability of only Aroclor or congener data depending on the sampling event introduces uncertainty into the risk estimates.

2.17 COMPARISON OF UNDEPURATED AND DEPURATED CLAM SAMPLES

Clam tissue throughout most of the Study Area was analyzed as undepurated samples, and a limited number of clam samples were depurated before analysis. The depurated clam tissue accounted for only five of the 22 clam samples collected for the BHHRA dataset, and the depurated samples were collected from edges of the site (northern and southern stretches). A comparison of the exposure point concentrations for depurated and undepurated clam tissue collected from the same exposure areas is provided in Table F6-13.